Low Profile Printed Dipole Array

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***Abstract*-A low profile printed dipole array for wireless application is presented. The proposed array by using folded feeding technique lowers the height of the whole array. The dipoles and integrated baluns are printed on one substrate. The whole feeding network is printed on another substrate. These two substrates are perpendicular. A circular array of this kind with a diameter of 260mm is designed. The simulated and tested results show that this novel structure can achieve low sidelobe and low cross polarization.**

I. INTRODUCTION

Many wireless communication applications need low cost, low profile, and wideband antennas. Integrated balun-fed printed dipole antennas [1,2] can meet these requirements. To produce a unidirectional radiation, it entails a planar ground which is placed at a distance about below the dipole arms [3], where is the wavelength of the center operating frequency (10GHz). Traditionally, the feeding network and printed dipole linear array are printed on the same substrate board [4]. So the feeding network increases the height of the array.

In this letter, a folded feeding printed dipole is proposed. By using this folded feeding dipole and a planar feeding network, the height of a planar array is limited to about . The simulated and tested results show that this circular array achieves good performances. Its sidelobe levels is lower than -20dB and cross polarization is lower than -25dB. It is a good candidate for the wireless communication systems.

II. ANTENNA ELEMENT DESIGN

Fig.1 shows the configuration of a folded feeding printed dipole. The dipole and the integrated balun are printed on each side of a 0.5mm thick substrate (so-called ‘substrate-I’) with a dielectric constant of . The feeding network with a grounded plane is printed on another substrate (named ‘substrate-II’) with a 0.5mm thickness and a dielectric constant of 2.2. There is a slot on the substrate-II, so substrate-I can be vertically inserted into the slot. Each integrated balun and the microstrip line of the feeding network is perpendicularly soldered together to form the folded feeding microstrip line.

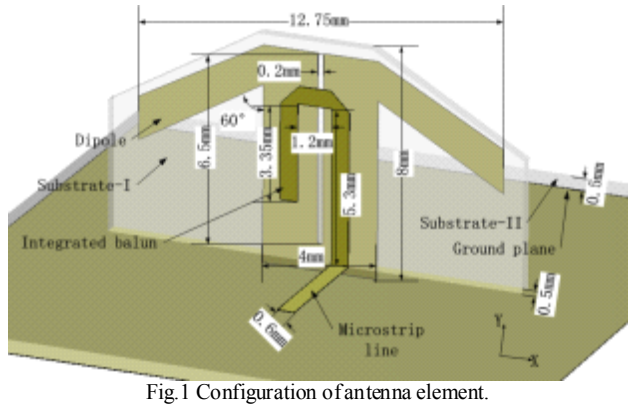


Fig.1 Configuration of antenna element.

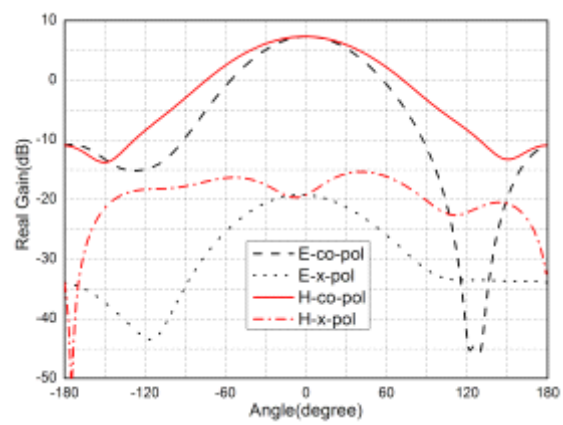


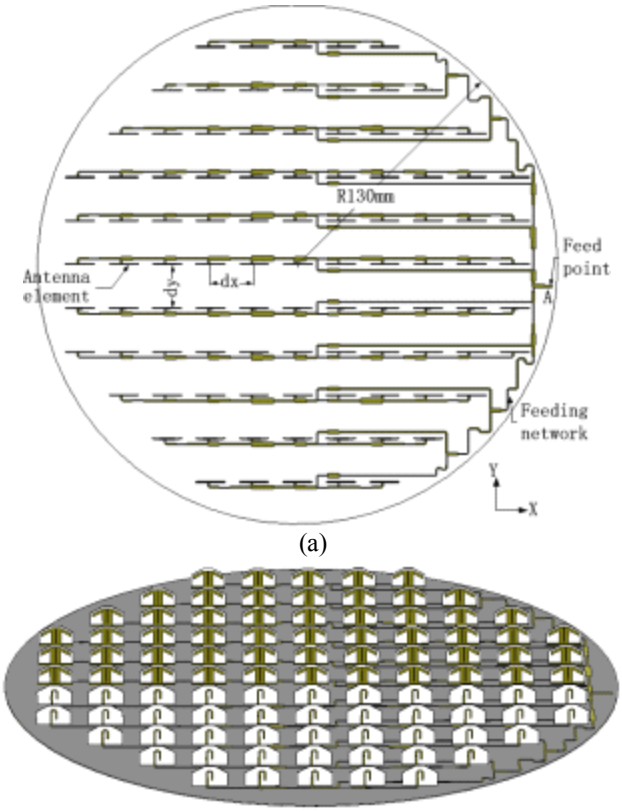
Fig.2 Radiation pattern of an antenna element.

Fig.2 shows the far-field patterns of an antenna element at 10GHz. The realized gain of the element is 7.3dB. The cross polarization of the H-plane and E-plane are all below -23dB. And the cross polarization of the H-plane is 5dB lower than E-plane. The results show that this folded feeding printed dipole can achieve good performance.

III. ARRAY DESIGN

Based on the element designed above, a two dimensional circular array with a 260mm diameter is designed. Fig.3 shows the structure of the two dimensional array. Fig.3a shows the top view of the array. It clearly exhibits the feeding networks. Each element in the sub-array and each sub-array are both series fed by the microstrip lines. The feeding ends of the sub-arrays are combined at point A. The height of the array is the same as the single element. So using such structure can greatly lower the array profile. Fig.3b shows the perspective view of the array. The elements in the north half

are mirror image of the south half. So the total E-field along the Y direction is cancelled. There forth, in the main radiation direction, the H-plane cross-polarization generated by the Y-direction E field is greatly suppressed.



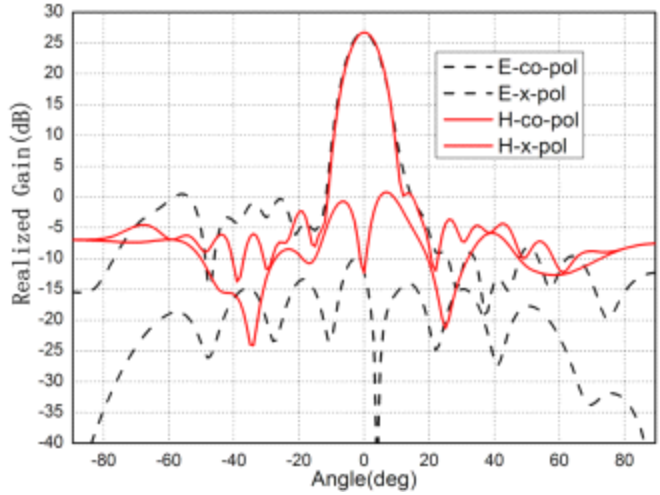
(a)

(b)

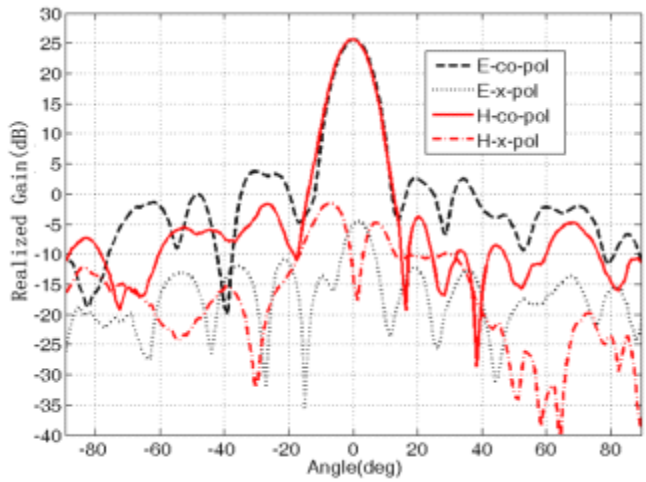
Fig.3 Configuration of the folded feeding printed dipole Array. (a) Top view, (dx=dy=21.7mm). (b) Perspective view.

The realized gain patterns are shown in Fig.4. Fig.4a shows simulated results. The sidelobe level of the E-plane main polarization pattern is below -25dB. Due to the asymmetry feeding networks, the right sidelobe level is about 8dB lower than the left sidelobe. E-plane achieves good cross-polarization performance which is below -35dB. The sidelobe level of the H-plane main polarization pattern is below -25dB too. But the H-plane cross-polarization level is about 10dB higher than the E-plane's, owing to Y-direction E-field generated between the integrated balun and the printed dipole antenna. As we can see the H-plane cross polarization pattern has a null in the main beam direction.

Fig.4b shows tested results. The tested gain is about 1dB lower than the simulated results, owing to the substrate loss and the ohmic loss of the feeding network. The main polarization sidelobe levels are all below -20dB, which can meet the engineer application demands. And the tested cross-polarization levels are all below -25dB.



(a)



(b)

Fig.4 Array's radiation pattern. (a) Simulated results, (b) Tested results.

IV. Conclusion

This paper presents a new low profile printed dipole array. This array is suitable for wireless system applications. Novel folded feeding structure greatly lowers the array profile by height. The simulated and tested results show that this array can achieve good performance of low sidelobe (<-20dB) and low cross polarization (<-25dB).

References

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